Oscilloscope OS2000
Instruction Manual

ADVANCE
INSTRUMENTS

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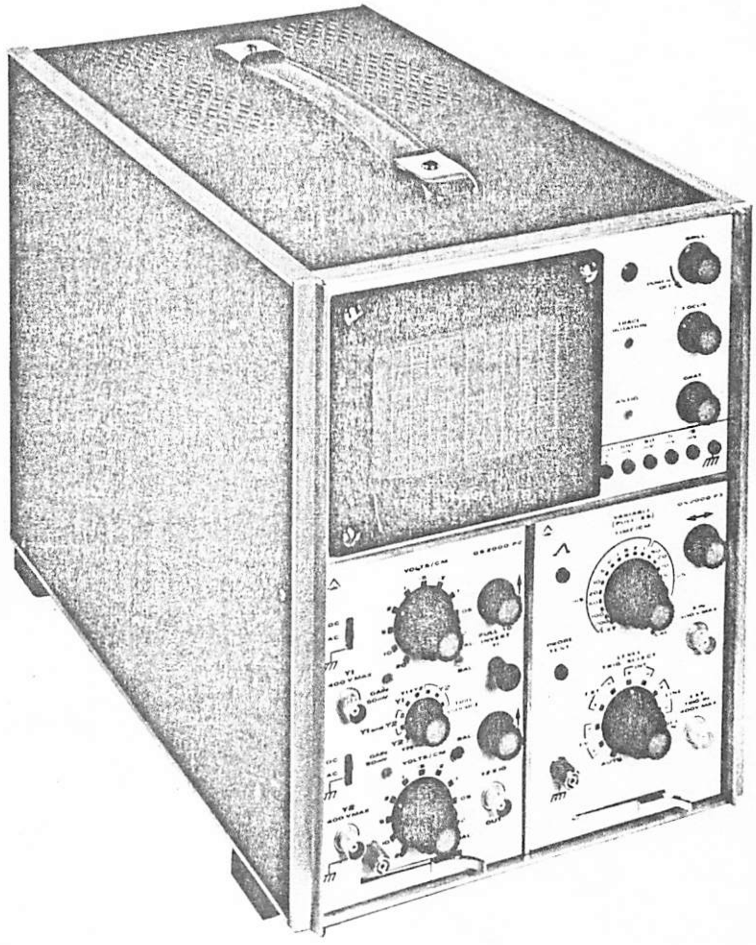
II-4-2



The general purpose Oscilloscope OS2000 is a portable instrument employing plug-in Y amplifiers and timebase units for maximum versatility. Solid state devices mounted on printed boards are employed throughout to give high reliability, simple maintenance, and minimum weight.

The main frame carries the cathode ray tube, power supplies signal delay circuit and output amplifiers, together with the controls associated with the display. The Y amplifier fits the left-hand aperture in the main frame and houses the Y preamplifier and beam switch circuits, the VOLT/CM (sensitivity), and TRIGGER SOURCE (mode) controls. The timebase generator is housed in the right-hand aperture of the front panel and contains the trigger amplifier and the timebase generator, the TIME/CM (velocity) and TRIG SELECT controls.

A comprehensive range of plug-in units is available to suit most applications; it includes single and dual trace wide band amplifiers, a high gain differential amplifier, standard and delayed timebase units. All plug-in units are fitted with a simple quick-action lever release mechanism and a retaining peg which holds them securely in place during operation.

The wide band preamplifiers give a bandwidth of DC to 20MHz at a maximum sensitivity of 10mV/cm. The dual trace plug-in Y amplifier features automatic changeover from alternate sweep display to chopped mode to suit the timebase speed. Internal triggering may be obtained from Y1 or Y2 only, on the dual trace unit, the required trigger source being selected automatically as the mode switch is changed. A fast warm-up cathode ray tube permits the oscilloscope to be fully operational within 15 seconds of switching on.

2.1 MAIN FRAME OS2000

CATHODE RAY TUBE Single gun 10cm x 6cm rectangular cathode ray tube with helical PDA operating at 4dV overall. P31 phosphor standard
P7 phosphor optional
GRATICULE ILLUMINATION Variable by front panel control
CALIBRATOR 250mV, 100mV, 50mV and 0.5mV ±2%, 50 or 60Hz available at front panel sockets
Z MODULATION 30V pk.pk. fully modulates trace via socket on rear panel
SIGNAL DELAY Approximately 200nS
POWER SUPPLY 95 to 130V, 190 to 260V, 50 or 60Hz, 60 to 70A depending on plug-in units. All supply rails are stabilised by a constant voltage transformer
DIMENSIONS 10 in (25cms) wide, 11½ in (29cm) high, 17½ in (44.5cms) deep
WEIGHT 35lb (15.9kg) - complete with two plug-in units

2.2 SINGLE TRACE UNIT OS2001Y

BANDWIDTH DC to 20MHz (3dB)
SENSITIVITY 50mV/cm
INPUT ATTENUATOR Switched nine-position attenuator giving sensitivities of 50mV/cm to 20V/cm in 1.2.5. sequence
INPUT IMPEDANCE 1MΩ/35pF approximately
MAXIMUM INPUT ±400V (DC and LF only)
INPUT COUPLING AC DC GROUND
MEASURING ACCURACY ±5%

2.3 DUAL TRACE UNIT OS 2002Y

BANDWIDTH/SENSITIVITY
(1) DC to 20MHz (-3dB) at 10mV/cm
(2) 5Hz to 5MHz (-3dB) at 1mV/cm by cascading channels
INPUT ATTENUATOR Eleven position switched attenuator giving sensitivities of 10mV/cm to 20V/cm in a 1.2.5. sequence. Fine gain control reduces sensitivity to 3:1 to give uncalibrated control over entire range
INPUT IMPEDANCE 1MΩ/35pF approximately
MAXIMUM INPUT ±400V (DC and LF only)
INPUT COUPLING AC DC GROUND
MEASURING ACCURACY ±5%
OPERATING MODES (1) Channel 1 only
(2) Channel 2 only
(3) Channel 1 and Channel 2 chopped at 100kHz on 8 slowest timebase speeds and alternate sweep on 11 uper speeds
(4) Channel 2 plus Channel 1 (sum)
Automatically selected by timebase range switch
(5) Channel 2 minus Channel 1 (difference by inverting Channel 1)
(6) Channel 2 as x10 preamp for Channel 1
TRIGGER PICKOFF From Channel 1 or Channel 2

2.4 STANDARD TIMEBASE OS2003X

SWEEP SPEEDS 19 ranges from 200mS/cm to 0.2μS/cm in 1.2.5. sequence. Fine velocity control gives 3:1 reduction.
Longest sweep time greater than 5 seconds
MEASURING ACCURACY ±5%
TRIGGER SOURCE (1) Internal (2) External (3) Line (50 or 60Hz) (4) TV frame (5) Free run
TRIGGER SLOPE Positive or negative
TRIGGER LEVEL (1) Manual (2) Auto (40Hz to 20MHz)
TRIGGER SENSITIVITY (1) Internal 1.5mm vertical deflection typical (2) External typically 300mV
EXTERNAL X Selected on timebase range switch
Sensitivity 10V or 2V/cm DC to 250kHz
X GAIN Switched x5

2.5 ACCESSORIES

MAIN FRAME OS2000
PL81 Connector Lead
PL44 Connector Lead
PL43 Connector Lead
2mm Plug Red
2mm Plug Black

OPTIONAL ACCESSORIES
Probe Kit
Carrying Case

3.1 PREPARATIONS FOR USE

WARNING The power transformer is a constant voltage unit and the line frequency has been specified when the instrument was ordered.
NO OTHER FREQUENCY MUST EVER BE USED

When despatched from the factory, the transformer tappings will be set for 190-260V on 50Hz models and 95-130V on 60Hz models. Access to the transformer may be obtained by removing the bottom panel. The AC power input is always connected to terminals 1 and 3. For 190-260V working, link terminal 2 to 4; for 95-130V working, link terminals 1 to 2 and 3 to 4.

3.2 FRONT PANEL CONTROLS

The functions of the front panel controls are as follows:

(a) SINGLE TRACE Y AMPLIFIER OS2001Y
The single channel Y amplifier has three controls and two connectors on the front panel. These are as follows:
DC/AC GROUND This three-position slide switch selects DC or AC coupling or grounds the input of the Y amplifier, but not the signal.
Y IN This co-axial input socket receives input signals up to 400V peak
VOLTS/CM This nine-position switch selects sensitivity from 50mV/cm to 20V/cm in 1. 2. 5. steps
Y SHIFT This control, designated by a vertical double-headed arrow, moves the trace vertically up and down the cathode ray tube. A groundbinding post is provided on the front panel at the bottom right-hand corner.

(b) DUAL TRACE Y AMPLIFIER
The dual trace Y amplifier has identical sets of controls for the Y1 and Y2 channels and three non-duplicated controls.
DC/AC GROUND This three-position slide switch selects DC coupling, AC coupling, or grounds the input of the Y1 amplifier, but not the input signal.
Y1 (400V max). This co-axial input socket accepts input signals up to 400V peak maximum
VOLTS/CM This is a dual control. The rear knob controls an eleven-position switch to select amplifier sensitivity in 1. 2. 5. steps from 10mV/cm to 20V/cm; the front knob operates a fine sensitivity control ha ing a 3:1 range, which must be turned fully clockwise to the CAL position to achieve the calibrated sensitivities.
Y SHIFT This control is identified by a vertical two-headed arrow; it moves the Y1 trace vertically up and down the screen face
GAIN 50mV This control may be operated with a screwdriver through the hole in the front panel; it is adjusted with the VOLTS/CM control at .05 and CAL to give a sensitivity of 50mV/cm from the Y1 input socket
BALANCE This preset control may be operated with a screwdriver through the hole in the front panel; it is adjusted to minimise trace shift when the amplifier sensitivity is changed from 10mV/cm to 50mV/cm
A similar set of controls is provided for the Y2 channel
The non-duplicated controls are as follows:

PULL TO INVERT Y1 This pull switch inverts the trace on the Y1 channel to permit differential operation in the Y1+Y2 mode, (i.e. Y2-Y1)
Y2 x 10 OUT This socket carries an output from the Y2 sync amplifier which may be used as an input to the X amplifier for phase comparison measurements, or to the Y1 amplifier to provide a sensitivity of 1mV/cm AC coupled
TRIGGER SOURCE (mode) This six-position switch selects the display available from the Y1 and Y2 channels and determines which channel provides the timebase trigger signal. The six possible combinations are as follows:
Y1+Y2; Y1 and Y2 (triggered from Y2)
Y1 and Y2; Y1+Y2 (triggered from Y1)
A ground binding post is provided in the bottom l left-hand corner of the front panel.

(c) STANDARD TIMEBASE PLUG-IN UNIT OS2003X
The front panel carries five connectors and three controls, two of which have dual functions. They are as follows:
TIME/CM This is a dual control. The rear knob operates a twenty-position switch which selects the timebase velocity from 0. 2μS/cm to 200mS/cm, with an external X position; the front knob provides smooth control of velocity to interpolate between the switched ranges and must be turned fully clockwise to the CAL position to obtain the calibrated velocity. If the front knob is pulled forward, the gain of the X amplifier is increased x5, increasing the timebase velocity by the same amount. A dayglow disc behind the knob indicates that x5 has been selected.
TRIG SELECT/LEVEL This is a dual control. The rear knob operates a nine-position switch to select the trigger source from TV+, TV-EXT+, EXT-, INT+, INT-, LINE+, LINE-, or to set the timebase to FREE RUN. The front knob is the trigger level control which must be turned fully counter-clockwise until the associated switch operates to obtain AUTO operation.
X SHIFT This control is designated by a horizontal double-headed arrow; it moves the trace horizontally across the tube.
TIMEBASE OUTPUT This socket is designated by a single saw-tooth waveform. It provides access to the bootstrap circuit so that the timebase wave-

form may be used to operate a swept oscillator or similar device. A signal of 4V pk. pk. is available into 10kΩ.

PROBE TEST This socket carries a rectangular waveform from the timebase bistable and may be used as an input signal for adjusting passive probes. Using a x10 probe, the Y amplifier sensitivity should be set to 100mV/cm and the timebase velocity should be adjusted to 1mS/cm for best results.

X IN (400V)* This socket gives access to the X amplifier when the TIME/CM switch is in the EXTERNAL position; it is used for making phase comparison measurements.

EXTERNAL TRIG IN (400V max) The timebase may be triggered by an external signal fed into this socket when EXT+ or EXT- is selected on the TRIG SELECT switch

*WARNING RF signals should be restricted to much lower levels because of current drawn by the input capacitance.

(d) MAIN FRAME CONTROLS

The main frame controls are located to the right of the cathode ray tube and are associated with the cathode ray tube display

BRILL Adjusts the brilliance of the display, giving a brighter trace as the control is turned clockwise. An associated switch is opened in the fully counter-clockwise position to switch off the power

FOCUS Controls the sharpness of the trace

GRAT Controls the graticule illumination

TRACE ROTATION The preset control behind this hole in the front panel may be adjusted with a screwdriver; it should be set so that the timebase runs horizontally, aligned with the graticule.

ASTIG This preset control should be adjusted with a screwdriver to equalise focusing at all parts of the screen

CALIBRATION OUTPUTS The five output sockets at the bottom right-hand corner of the front panel carry calibration voltages at supply frequency. These may be connected to the input of the Y amplifier for checking the calibration and adjusting the 50mV/cm control.

3. 3 SWITCHING ON FOR THE FIRST TIME

WARNING Do not operate the oscilloscope with the plug-in units removed. Always switch off before removing a plug-in unit. To obtain a trace:

(i) Switch on the instrument by rotating the BRILL control clockwise to three-quarters of its full rotation

(ii) Select Y1 and Y2 on the dual trace unit

(iii) Set both Y SHIFTS and the X SHIFT approximately central.

(iv) Set the TRIG SELECT control to FREE RUN

(v) Two horizontal lines should appear on the cathode ray tube within 15 seconds of switching on (only one line with a single beam Y plug-in). If no trace appears, turn the BRILL control slowly clockwise and rotate the X and Y SHIFT controls slowly until the trace is located. Adjust the SHIFT controls to centre the traces

(vi) If the traces are not horizontal, adjust the TRACE ROTATION control to align them with the graticule lines

3.4 THE CALIBRATOR WAVEFORM

(i) Set the Y1 input switch to DC

(ii) Set the MODE switch to Y1 (this instruction is not applicable on a single trace unit).

(iii) Connect the 250mV CAL output to the Y1 socket

(iv) Set the Y1 VOLTS/CM control to .05

(v) Set the TIME/CM control to 10mS/cm

(vi) Set the TRIG SELECT to INT+

(vii) Rotate the LEVEL control counter-clockwise to the AUTO position

(viii) Adjust the FOCUS and ASTIG controls; FOCUS should be adjusted for a sharp trace at the centre of the screen and ASTIG for a sharp trace at the upper and lower centres of the screen. The calibration waveform should now be displayed

3.5 CALIBRATION SETTING AND VERIFICATION

(i) Obtain a display of the calibration waveform as described in paragraph 3.4

(ii) Set the Y1 variable VOLTS/CM control to the CAL position

(iii) Adjust the Y1 50mV/cm preset control for a vertical display of 5cm

(iv) Connect the waveform to the Y2 input and switch the MODE switch to the Y2 position

(v) Set the Y2 variable VOLTS/CM control to the CAL position, and the VOLTS/CM switch to .05V/cm

(vi) Adjust the preset 50mV/cm control to obtain a display of 5cm

(vii) Turn the variable TIME/CM control fully clockwise to the CAL position and push back the knob to ensure that the X gain is in the x1 position

(viii) For 50Hz supplies, one cycle of the calibration waveform should occuply 2cm of the trace; for 60Hz supplies, the waveform should occupy 1.67cm approximately, or set for 6 cycles in 10cm

3.6 GENERAL OPERATION

(i) The dual trace Y amplifier MODE switch permits operation of this amplifier as a single trace unit using Y1 channel, or Y2 channel. As a dual trace unit, it displays the two input signals on two traces, using 'beam switch' at low timebase speeds and alternate trace display at high timebase speeds. The Y1+Y2 mode permits this plug-in to be used as a summing amplifier, Y2-Y1 is displayed when Y1+Y2 is selected and the PULL TO INVERT Y1 switch is operated.

To obtain the best common mode rejection in the differential mode, it is necessary to set the gain of the two channels exactly equal. To do this, one channel is calibrated as described above, and the same signal is then applied to both channels in the Y2-Y1 mode. The gain of the second channel is adjusted until the residual signal is minimised. The common mode rejection obtained will vary slightly at other settings of the VOLTS/CM controls due to tolerance of the attenuator resistors.

(ii) DC/AC/GROUND In the DC mode, the input signal is connected directly to the amplifier input. In the AC mode, a 400V DC working, 0.1μF capacitor is inserted between the input socket and the amplifier input.

In the GROUND mode, the input socket is isolated and the amplifier is grounded to facilitate balance adjustments and setting up of DC levels.

(iii) BANDWIDTH The specified bandwidth of the instrument is 20MHz but the typical bandwidth obtained is 25-30MHz on all but the two most sensitive ranges which have a bandwidth from 20-25MHz

iv) AC x 10 A sensitivity of 1mV/cm may be obtained by connecting a screened lead between the Y2 x 10 output and the Y1 input socket. The incoming signal is connected to the Y2 input and the Y2 VOLTS/CM control is set to 01. The overall sensitivity of the Y1 channel is then increased x 10. In this mode, the input signals should not exceed 0.1V peak-to-peak;the Y1 channel controls should be used for shift and sensitivity adjustment;and the trigger source switch set to Y1 triggered from Y1.

(v) BALANCE If any movement of the trace is detected when the VOLTS/CM control is moved from .05 to .02 and .01, the preset balance control on the front panel should be adjusted to minimise the movement

(vi) TIMEBASE VELOCITY All the controls associated with timebase velocity are in the upper centre position of the X plug-in unit. The TIME/CM switch is calibrated in 1.2.5. steps and will provide accurate time measurement when the fine velocity, adjusted by the front knob, is set fully clockwise to the CAL position. The X gain maybe increased x5 by pulling forward the front knob; in this position a dayglow disc is visible behind the knob

(vii) TRIG SELECT The TRIG SELECT offers four major triggering modes, each with positive or negative polarity and the free run mode. When TV TRIGGER is selected, an integrating circuit is applied to the internal triggering waveform so that line pulses are ignored and the timebase triggers only from the frame pulse. This mode may also be used for triggering from LF signals in the presence of HF noise.

External triggering from a signal applied to the EXT TRIG IN socket is used when viewing pulses from sources having a triggering prepulse. The prepulse is connected to the EXT TRIG IN socket while the signal is connected into the Y amplifier. External triggering may also be used for viewing signals in the presence of jitter, i.e., computer pulses, the trigger signal being supplied from the computor clock pulse

INTERNAL TRIGGER On dual trace operation the trigger channel is selected by the TRIG SOURCE (mode) switch

LINE TRIGGER The timebase is triggered at 50Hz or 60Hz from the AC power input. This mode is useful for investigating residual hum in power supplies, examining hum modulation on oscillators, and checking whether undesirable signals are synchronised to line frequency

FREE RUN The timebase free runs at all settings of the TIME/CM switch whether a trigger signal is present or absent. This is useful when searching for a trace or when using the timebase waveform for external purposes. +. - selects the rising or falling edge of a waveform as the triggering source. This is not usually critical when viewing sine waves but is very useful when viewing pulses

(viii) LEVEL This variable control is operated by the front knob of the TRIG SELECT and determines the point on the rising or falling edge at which the timebase triggers. It has a particular use in selecting a large amplitude pulse as the only trigger source in the presence of a train of smaller pulses.

AUTO This mode is obtained when the level control is turned fully counter-clockwise to the switch position. In this mode, triggering is automatic, giving ideal conditions for general purpose use, i.e. viewing sine waves and repetitive pulse waveforms. Polarity selection must be correctly made when viewing low repetition rate pulses. In the AUTO mode, the timebase runs at apprximately 40Hz in the absence of a trigger signal but automatically locks to any incoming trigger. The trace obtained in the AUTO mode is visible at slow timebase speeds but tends to disappear as the timebase velocity is increased above 100μS/cm

3.7 PHOTOGRAPHY

The Shackman camera Type PL5 is recommended for use with the OS2000 Oscilloscope. It is a polaroid-backed sheet-film camera able to take a photograph every few seconds. An adaptor is available for attaching the camera to the oscilloscope.

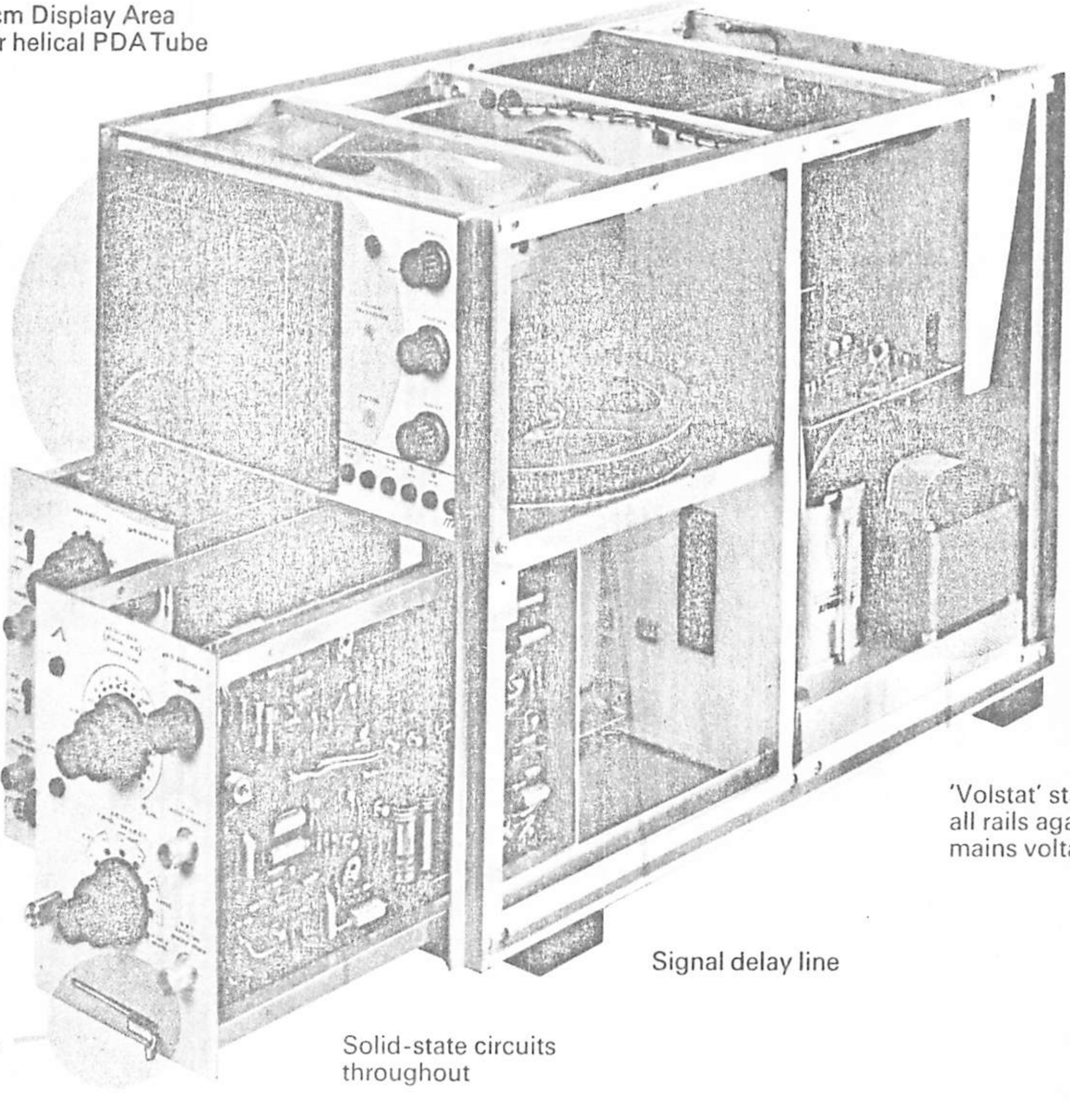
Almost any other oscilloscope camera may be used with the OS2000, but a suitable adapator must be obtained and references should be made to the camera manufacturer on this subject.

3.8 CRT PHOSPHORS

The OS2000 Oscilloscope is normally fitted with a P31 cathode ray tube, although a P7 may be fitted if specified with the order.

Phosphor	Use	Light Output Comparison	Persistence	Colour	Filter	Availability
GH(P31)	General purpose High brightness High writing speed photography	100%	Medium Short 100µS-1mS	Green at Low Brill Blue-green at High Brill	Green or Blue-green	Standard
GM(P7)	DC & Low frequency below 30Hz Long persistence	25%	Long 1-5S	Blue flash Yellow persistence	Blue to redue persistence, orange to enhance persistence	Optional
GJ(P1)	Replaced by GH	70%	Medium 10-100mS	Green	Green	Obsolete

SUPPLEMENT FOR
OS2001Y, OS2002Y & OS2003X
PLUG-IN UNITS



Large 10 x 6 cm Display Area
on rectangular helical PDA Tube

'Volstat' stabilises
all rails against
mains voltage changes

Signal delay line

Quick-release
on plug-ins

Solid-state circuits
throughout

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1.1 OS2001Y AND OS2002Y

These Y input plug-in units for the OS2000 family of oscilloscopes combine the minimum of front panel controls, and hence simplicity of operation with wide bandwidth and stability.

The double channel OS2002Y offers eleven switched sensitivity ranges from 10mV/cm to 20V/cm with a variable control giving overlap on all the ranges.

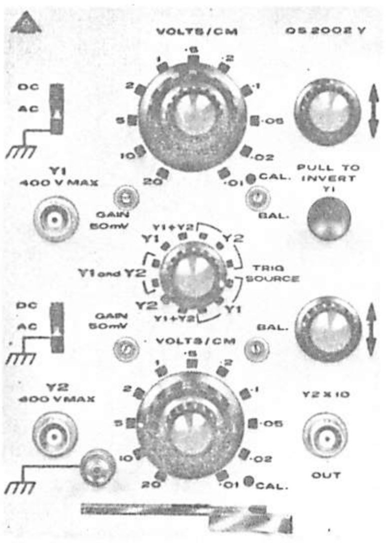
The single channel OS2001Y offers nine switched ranges from 50mV/cm to 20V/cm.

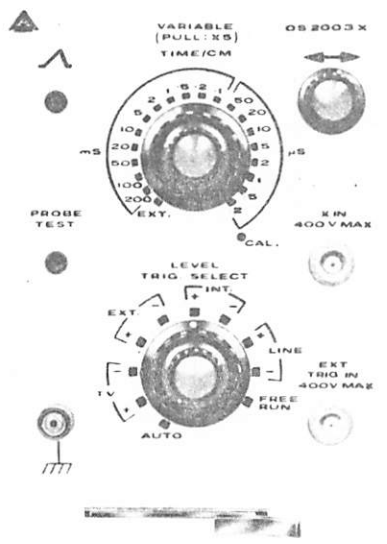
The OS2002Y provides display modes of Y1 only; Y2 only; Y1 and Y2 dual beam display; or Y1 + Y2 added algebraically on single beam display. The separate facility to invert Y1 allows differential operation in the Y1 + Y2 mode. Also, the channels may be cascaded to give a sensitivity of 1mV/cm.

1.2 OS2003X

This time base plug-in unit for the OS2000 family of oscilloscopes has a minimum number of controls without the sacrifice of performance. The sweep range extends from 200mS/cm to 200nS/cm., with a X5 magnifier giving the equivalent of 40nS/cm. There is a variable time/cm control which gives overlap on all the ranges. This switch also selects the external mode for horizontal deflecting signals.

The trigger sources are selected by a single rotary switch mounted concentrically with the AUTO and LEVEL control. These sources are internal, from the Y plug-in unit, external (via a front panel socket); T.V. for triggering internally from frame sync. pulses; and Line, for triggering from the A.C. supply.





Specification

Section 2

Specification applies in OS2000, OS2000R, OS2100 and OS2100R unless otherwise stated.

2.1 Y PLUG-IN UNITS OS2001Y & OS2002Y

PARAMETER	OS2001Y	OS2002Y
BANDWIDTH		
OS2000/2000R	DC – 25 MHz	DC – 25 MHz
OS2100/2100R	DC – 25 MHz	DC – 25 MHz
BW/Cascaded		50Hz – 5MHz
Sensitivity	50mV/cm	10mV/cm
Sensitivity Cascaded		1mV/cm
Input Attenuator	Switched 9 position attenuator giving sensitivities of 50mV/cm to 20V/cm in 1.2.5 sequence.	Switched 11 position attenuator giving sensitivities of 10mV/cm to 20V/cm in 1.2.5. sequence. Fine gain control reduces sensitivity to give uncalibrated control over the entire range.
Input Impedance	1MΩ shunted by 35pf approx.	1MΩ shunted by 35pF approx.
Maximum Input	±400V (DC & LF only)	±400V (DC & LF only).
Input coupling	DC. AC & Ground	DC. AC & Ground.
Measuring Accuracy	±5%	±5%
Operating Modes	Single Beam	(1) Channel Y1 only. (2) " Y2 " (3) " Y1 and channel Y2, chopped at approx. 100kHz on timebase speeds up to 1mS, alternate sweeps on faster rates. (4) Channels Y1 + Y2, the algebraic sum. (5) Channel Y1 inverted. (6) Channel Y2 as X10 pre amplifier. Trigger pick off from channel Y1 or Y2 in modes (3) and (4).
Weight	2lb.	3¾lb.

ACCESSORIES (Normally supplied with the main frame)

Connector	BNC – BNC (2')	PL43
Connector	BNC – BNC (8")	PL81
Connector	BNC – CROCODILE CLIPS	PL44

Plug	2mm	Red	26802
Plug	2mm	Black	26803

ACCESSORIES (Optional)

Adaptor, BNC – Binding Post	26234
Lead, Plug-in Extender	PL82
Passive Probe Kit	25362

2.2 X PLUG-IN UNIT – OS2003X

SWEEP SPEEDS

19 ranges from 200mS/cm to 0.2μS/cm in 1.2.5. sequence. Fine velocity control gives 3:1 reduction.

Longest sweep time greater than 5 seconds.

MEASURING ACCURACY

±5%.

TRIGGER SOURCE

(1) Internal (2) External. (3) Line (50 or 60Hz). (4) TV Frame. (internal) (5) Free run.

TRIGGER SLOPE

Positive or negative.

TRIGGER LEVEL

(1) Manual (2) Auto (40Hz to 20MHz)

TRIGGER SENSITIVITY

(1) Internal 1.5mm vertical deflection typical. (2) External typically 300mV.

EXTERNAL X.

Selected on timebase range switch.
Sensitivity 10V or 2V/cm, DC to 250kHz.

X GAIN

Switched x 5.

OUTPUTS

(1) PROBE TEST

A pulse of approx. +10V from a source of 10KΩ, present during the period of the sweep.

(2) RAMP

A linear ramp of approx. +4.5V from a source of 4.7KΩ present during the period of the sweep.

WEIGHT

2½lbs.

ACCESSORIES

(Normally supplied with the main frame)
Connector BNC – BNC (2') PL43
Connector BNC – BNC (8") PL81
Connector BNC – CROCODILE CLIPS PL44

Plug	2mm	Red	26802
Plug	2mm	Black	26803

3.1 OS2001Y, OS2002Y & OS2003X

These units can be used in the OS2000 series of main frames. The Y plug-in is inserted in the left hand aperture of the main frame, the timebase (X) plug-in is inserted into the right hand aperture of the main frame. Both are automatically held in place after being firmly pressed in. Withdrawal is by means of the lever at the bottom of the unit.

Always ensure that the supply is switched OFF before inserting or withdrawing plug-in units.

3.2 TRACE LOCATION

To find the trace, set the input coupling switch to ground. On the 0S2002Y set both input switches to ground and select the required mode of operation with the function switch. Set the timebase trigger switch to FREE RUN. With the X and Y shift controls in their mid positions a trace should be visible on the cathode ray tube screen when the brilliance control on the main frame is set correctly.

3.3 INPUT SIGNAL CONNECTION OS2001Y and OS2002Y

DC/AC/GROUND SWITCH. In the DC mode, the input signal is connected directly to the amplifier input. In the AC mode, a 400V DC working, 0.1μF capacitor is inserted between the input socket and the amplifier input.

Select a suitable attenuator range and apply the input signal to the input coaxial socket using a screened lead to minimise pick up into the Y amplifier. On sensitive ranges ensure that the ground lead connection is near to the signal point.

When the input coupling switch is in the ground position the input socket is open circuited, the input to the amplifier only being shorted to ground, to facilitate balance adjustments and the setting up of DC levels.

3.4 PROBE

The input resistance of the Y plug-in is 1MΩ, shunted by approximately 35pF. The effective capacity of the input lead must be added to this and the resultant impedance can often load the signal source. Therefore it is advisable to use the 10MΩ x 10 probe, Pt.No. 25362. This reduces the input capacity and increases the input resistance, at the expense of the sensitivity. The probe contains a shunt C.R. network which forms an attenuator with the input C.R. of the Y plug-in. It is necessary to adjust the capacitance of the probe to match the input capacity of the plug-in to obtain a flat frequency response. For this set the Y input sensitivity to 100mV/cm and the timebase rate to 1mS/cm.

Connect the probe to the PROBE TEST socket on the 0S2003X timebase unit, or the 'GATE' output socket on the 0S2005X or 0S2006X timebases.

Adjustment of the capacitance is achieved by unscrewing the small knurled portion of the locking ring near the BNC connector at the Y plug-in end of the probe lead. The larger portion is the adjustable capacitor and this should be set for a level response, with no overshoot or undershoot visible on the display. The knurled locking ring should then be tightened against the capacitor ring.

3.5 MODES OF OPERATION 0S2002Y

With this plug-in there is the choice of display mode. The function switch selects the required mode together with the trigger source when displaying multiple input functions. The functions offered are, Y1 or Y2 only, the algebraic sum of Y1 plus Y2 and Y1 and Y2 simultaneously.

In this mode the beam switching employed is by chopping at slow timebase sweep rates and by alternate sweeps at higher rates. This change over is automatically achieved within the timebase unit.

By inverting Y1 and then selecting the display mode Y1 + Y2 the result is a differential signal (Y2 – Y1) being displayed.

To obtain the best common mode rejection in the differential mode, it is necessary to set the gain of the two channels exactly equal. To do this, one channel is calibrated as described in the maintenance section 5.5(6) and the same signal is then applied to both channels in the Y2 – Y1 mode. The gain of the second channel is adjusted until the residual signal is minimised. The common mode rejection obtained will vary slightly as other settings of the VOLTS/CM controls due to tolerance of the attenuator resistors.

AC x 10

A sensitivity of 1mV/cm may be obtained by connecting a screened lead such as the PL81, between the Y2 x 10 output and the Y1 input socket. The incoming signal is connected to the Y2 input and the Y2 VOLTS/CM control is set to 0.01V/cm. The Y1 display and trigger mode is selected. The overall sensitivity of the Y1 channel is then increased x 10. In this mode, the input signals should not exceed 0.1V peak-to-peak; the Y1 channel controls should be used for shift and sensitivity adjustment.

BALANCE

If any movement of the trace is detected when the VOLTS/CM control is moved from .05 to .02 and .01, the preset balance control on the front panel should be adjusted to minimise the movement.

Before using the plug-in to determine the amplitude of a signal ensure that the variable volts/cm control concentric with the attenuator switch is in the fully clockwise, CAL. position.

3.6 OS2003X

Select the required trigger mode and operate the LEVEL control to obtain a triggered display on the CRT screen. Use the timebase TIME/CM control to give the desired number of cycles of the input signal across the screen. The period, and therefore the frequency, of the input signal may be determined. Ensure before doing so that the variable TIME/CM control (the knob concentric with the TIME/CM switch) is fully clockwise, in the CAL position.

The TIME/CM switch is calibrated in 1.2.5. steps and will provide accurate time measurement when the fine velocity, adjusted by the front knob, is set fully clockwise to the CAL position. The X gain may be increased x5 by pulling forward the front knob.

There are four major triggering modes, each with positive or negative polarity and the FREE RUN mode. When TV TRIGGER is selected, an integrating circuit is applied to the internal triggering waveform so that line pulses are ignored and the timebase triggers only from the frame pulse. This mode may also be used for triggering from LF signals in the presence of HF noise.

External triggering from a signal applied to the EXT TRIG IN socket is used when viewing pulses from sources having a triggering prepulse. The prepulse is connected to the EXT. TRIG IN socket while the signal is connected into the Y amplifier. External triggering may also be used for viewing signals in the presence of jitter, e.g., computer pulses, the trigger signal being supplied from the computer clock pulse.

INTERNAL TRIGGER

On dual trace operation the trigger channel is selected by the TRIG SOURCE (mode) switch.

LINE TRIGGER

The timebase is triggered at line frequency (50Hz or 60Hz) from the AC power input. This mode is useful for investigating residual hum in power supplies, examining hum modulation on oscillators, and checking whether undesirable signals are synchronised to line frequency.

FREE RUN

The timebase free runs at all settings of the TIME/CM switch whether a trigger signal is present or absent. This is useful when searching for a trace or when using the timebase waveform for external purposes.

POSITIVE/NEGATIVE selects the rising or falling edge of a waveform as the triggering source. This is not usually critical when viewing sine waves but is very useful when viewing pulses.

LEVEL

This variable control is operated by the front knob of the TRIG SELECT and determines the point on the rising or falling edge at which the timebase triggers. It has a particular use in selecting a large amplitude pulse as the only trigger source in the presence of a train of smaller pulses.

AUTO

This mode is obtained when the level control is turned fully counter-clockwise to the switch position. In this mode, triggering is automatic, giving ideal conditions for general purpose use, i.e., viewing sine waves and repetitive pulse waveforms. Polarity selection must be correctly made when viewing low repetition rate pulses. In the AUTO mode, the timebase runs at approximately 40Hz in the absence of a trigger signal but automatically locks to any incoming trigger. The trace obtained in the AUTO mode is visible at slow timebase speeds but tends to disappear as the timebase velocity is increased above 100μS/cm.

EXTERNAL X

With the TIME/CM switch set to EXT the time base is disconnected and the input to the X deflection amplifier connected to the X IN front panel socket. The input signal is DC coupled with an impedance of approx 100K. The sensitivity is normally approx. 10V/cm. With the x5 X expansion selected, the sensitivity is approx. 2V/cm.